

MICROWAVE POWERED AIRSHIP SYSTEM DESIGN FOR HIGH-ALTITUDE POWER RELAY AND OTHER APPLICATIONS

Richard M. Dickinson

Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109, USA

The cost optimized point-design of a 2.45GHz microwave beam powered, 14.3 Mcuft helium filled airship that is station kept at 70,000 ft altitude for power relay between ground and space is presented. The incident RF power at the 150 ft diameter by 1000 ft long platform is of order 1.5 MW.

The dry mass of the vessel at 71% gross buoyancy is 38,500lbs with a 150 ft diameter rectenna mass of 2500 lbs. and a payload of 5500 lbs.

The maximum stationkeeping power for 99 percentile winds over the continental US of 127 fps is about 500kW or 672 horsepower for 80% efficient propellers driven by electric motors, assuming a drag coefficient of 0.035 and a fineness ratio of 6.7 for the airship.

The ground based limited (± 10 deg) steering 70m diameter beam waveguide antenna is fed from a linearly polarized array of injection phase-locked cooker tube magnetrons whose combined 4 MW output radiates through a fixed 45 deg venetian blind polarizing grid to render the field circularly polarized. Subsequently the radiated field continues in the beamed guide to another rotary polarizer which positions the final radiated linearly polarized antenna illumination.

The positionable linearly polarized field can track the weather vane cocking of the linearly polarized rectenna aboard the airship. Alternatively, the positionable polarization capability can be used to vary the output power to the rectenna or another orthogonal polarized payload.

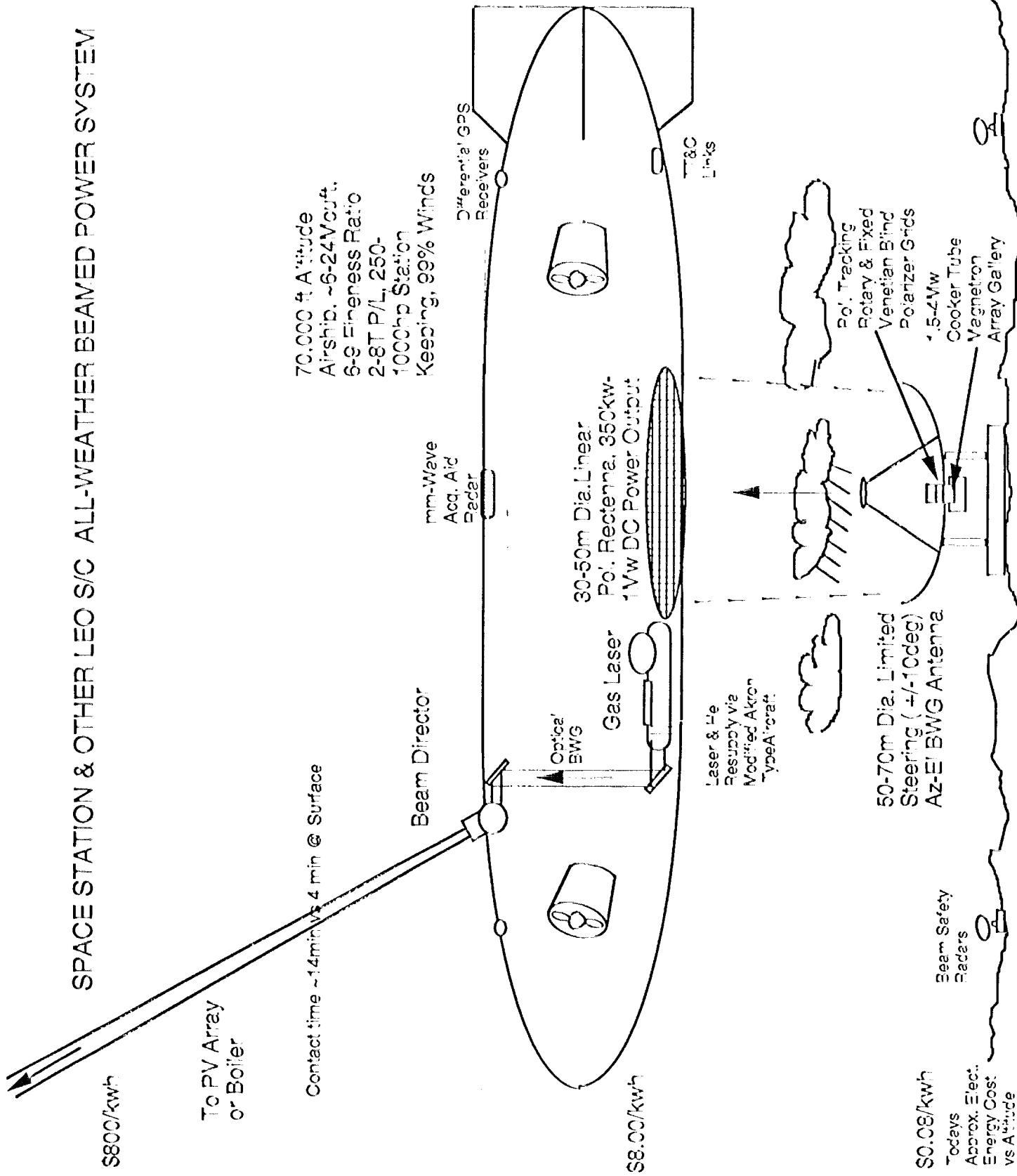
The system tradeoff between the combination of capital costs and operating costs of power and cost of gain for the transmitting antenna is shown to be minimum when both are approximately equal.

Because of the high altitude of the airship it is above most all of the weather and it can also extend the contact view time to low Earth orbiting spacecraft by a factor of three compared to ground based equipment. Consequently, laser or millimeter wavelength transmitters powered from the 2.45 GHz airship rectenna

dc power output can be used to beam power in an all weather link to the orbiting space assets suitably equipped with photovoltaics or mm-rectennas, respectively.

Other applications of the high altitude surrogate stationary satellite are for telecommunications and as an observation platform. Telecommunications can encompass AM, FM, and TV broadcasting, point of sale and inventory data relay, cellular telephones and paging for example. Observations from the platform can be for space, air, land and sea traffic monitoring and control, crop and weather watching, ice locations, border patrols, and astronomy.

SPACE STATION & OTHER LEO S/C ALL-WEATHER BEAMED POWER SYSTEM



70,000 ft Altitude
 Airship, ~6-24Vout,
 6-9 Efficiency Ratio
 2-8T P/L, 250-
 1000hp Station
 Keeping, 99% Winds

\$0.08/kwh
 Today's
 Approx. Elect.
 Energy Cost
 vs Altitude

Beam Safety
 Radars

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Dates for your diary :

Submission of abstracts : 15 January, 1997

Submission of full texts : 1 June, 1997